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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention relates to the polarization member which can form the liquid crystal display of high brightness which color nonuniformity cannot produce easily due to a transverse plane and the latus angle of visibility of the tropia.

[0002]

[Background of the Invention] Conventionally, what has arranged the polarization member which consists of a cholesteric-liquid-crystal layer of GURANJAN orientation and 1/4 wavelength plate on the side light type light guide plate which forms a back light for the purpose of a raise in the brightness of a liquid crystal display etc. was known. This suppresses the absorption loss by the polarizing plate, and enables it to aim at improvement in brightness by circular-polarization-of-light-izing outgoing radiation light by the light guide plate, linearly-polarized-light-izing it through 1/4 wavelength plate using the property to divide into the circular polarization of light on either side the incidence natural light which the cholesteric-liquid-crystal layer of GURANJAN orientation shows as the reflected light and the transmitted light, and supplying a polarizing plate.

[0003] However, in the conventional polarization member, when the tropia was carried out, there was a trouble which color nonuniformity generates. Although [this color nonuniformity] cholesteric-liquid-crystal layer thickness nonuniformity etc. is the cause, the technology in which the thickness precision which can prevent it can be attained is not known.

[0004]

[The technical technical problem of invention] the polarization which can form the liquid crystal display of high brightness with which color nonuniformity cannot produce this invention easily due to a transverse plane and the latus angle of visibility of the tropia -- let development of a member be a technical problem

[0005]

[Means for Solving the Problem] this invention offers the polarization member characterized by coming to prepare 1/4 wavelength plate in one side or the both sides of a cholesteric-liquid-crystal layer of GURANJAN orientation at least through an optical diffusion layer, and having a polarizing plate if needed, and the liquid crystal display characterized by the bird clapper using the polarization member.

[0006]

[Effect of the Invention] Coloring of the direction of the tropia can be reduced, color nonuniformity can be prevented, equalizing the circular polarization of light by the cholesteric-liquid-crystal layer by the optical diffusion layer, being able to supply 1/4 wavelength plate, and this maintaining the brightness of the direction of a transverse plane good according to the polarization member of this invention, and the liquid crystal display which is excellent in high brightness without color nonuniformity at display grace can be formed with a transverse plane and the latus angle of visibility of the tropia.

[0007]

[The operation gestalt of invention] The polarization member by this invention consists of what prepared

1/4 wavelength plate in one side or the both sides of a cholesteric-liquid-crystal layer of GURANJAN orientation at least through the optical diffusion layer. The example was shown in drawing 1. For 1, the cholesteric-liquid-crystal layer of GURANJAN orientation and 2 are [an optical diffusion layer and 3] 1/4 wavelength plates. In addition, the example of drawing shows what was used as the liquid crystal display, and, for 4 and 41, a polarizing plate and 5 are [a liquid crystal cell and 8] the light sources. [0008] About the cholesteric-liquid-crystal layer of GURANJAN orientation, there is especially no limitation and it can use the proper thing which shows the property of penetrating right-and-left one circular polarization of light for the incidence natural light, and reflecting another side. By using the cholesteric-liquid-crystal layer which shows this reflection / transparency property, increase of the quantity of light which is made to carry out incidence of the light from the light sources, such as a back light, obtains the transmitted light of a predetermined polarization state, supplies it in the state where a polarizing plate is hard to be absorbed, and can be used for a liquid crystal display etc. can be aimed at, and brightness can be raised.

[0009] Moreover, in the above, if the reflected light by the cholesteric-liquid-crystal layer is reversed through a reflecting layer etc. and re-incidence is carried out to a cholesteric-liquid-crystal layer, from the part's or all penetrating as a light of a predetermined polarization state, the quantity of the light which penetrates a cholesteric-liquid-crystal layer using the reflected light can be made to be able to increase, and brightness, such as a liquid crystal display, can be raised more.

[0010] A cholesteric-liquid-crystal layer may have the arrangement structure which superimposed two-layer or three layers or more in combination, although the thing from which the spiral pitch of GURANJAN orientation is different, therefore reflected wave length are different. What reflects the circular polarization of light in the latus wavelength ranges, such as a light region, by this superposition-ization can be obtained, and the transparency circular polarization of light of the latus wavelength range can be acquired based on it.

[0011] The cholesteric-liquid-crystal layer which shows the aforementioned reflection / transparency property can be obtained as a liquid crystal polymer layer which generally carried out GURANJAN orientation through the orientation film by rubbing processing etc. on the transparent base material, although it can also obtain as a liquid crystal polymer film etc.

[0012] Although there is especially no limitation about the material which forms the aforementioned transparent base material, generally polymer is used. As an example of the polymer, the cellulose system polymer like a diacetyl cellulose or a cellulose triacetate, The polyester system polymer like a polyethylene terephthalate or polyethylenenaphthalate, Polycarbonate system polymer and the acrylic polymer like a polymethylmethacrylate, Polystyrene and the styrene system polymer like an acrylonitrile styrene copolymer, Olefin system polymer, vinyl chloride system polymer, and nylon and the amide system polymer like an aromatic polyamide like the polyolefine which has polyethylene, polypropylene, a cyclo system, or norbornene structure, or an ethylene propylene rubber are raised.

[0013] Moreover, the polymer hardened by heat, UV irradiation, etc., such as the blend object of imido ** polymer, sulfone system polymer, polyether sulphone system polymer and polyether ether ketone system polymer, polyphenylene-sulfide system polymer and vinyl alcohol system polymer, vinylidene-chloride system polymer and vinyl butyral system polymer, ant rate system polymer and polyoxymethylene system polymer, epoxy system polymer, or the aforementioned polymer or a polyester system, acrylic, an urethane system and an amide system, a silicone system, and an epoxy system, can be used for formation of the aforementioned transparent The transparent base material which is excellent isotropic is preferably used like a cellulose system film.

[0014] On the other hand, for the purpose of linearly-polarized-light-izing the circular polarization of light which penetrated the cholesteric-liquid-crystal layer, 1/4 wavelength plate arranged through an optical diffusion layer to a cholesteric-liquid-crystal layer can prevent an absorption loss by arranging a polarizing plate so that the transparency shaft may be as much as possible in agreement to the plane of vibration of the linearly polarized light which penetrated 1/4 wavelength plate, and, thereby, can raise brightness more. The proper thing according to the former, such as what supported the form birefringence film which consists of an oriented film of various polymer etc., the oriented film of the

liquid crystal polymer like a discotic system or nematic **, and its orientation liquid crystal layer on the transparent base material as $1/4$ wavelength plate, can be used.

[0015] In addition, as for the polymer which forms the aforementioned form birefringence film, what was illustrated by the above-mentioned transparent base material may be proper. Above all, for example, polyester system polymer and the polymer which is excellent in crystallinity like a polyether ether ketone can use preferably. You may process an oriented film by the method with proper one shaft, two shafts, etc. Moreover, you may be the form birefringence film which controlled the refractive index of the thickness direction of a film by the method which gives a shrinkage force or/, and the extension force to the bottom of adhesion with a thermal-contraction nature film.

[0016] $1/4$ wavelength plate may carry out the laminating of the phase contrast layer more than two-layer for the purpose of control of optical properties, such as phase contrast. What functions as $1/4$ wavelength plate in the latus wavelength ranges, such as a light region, with the method which superimposes the phase contrast layer which shows the phase contrast layer which incidentally functions as $1/4$ wavelength plate to the homogeneous lights, such as light with a wavelength of 550nm, and other phase contrast properties, for example, the phase contrast layer which functions as $1/2$ wavelength plate, can be obtained.

[0017] A cholesteric-liquid-crystal layer and the optical diffusion layer made to be placed between wooden floors $1/4$ wave aim at equalizing the reflected light or/, and the transmitted light by the cholesteric-liquid-crystal layer, and supplying $1/4$ wavelength plate. As this described above, the color nonuniformity of the direction of the tropia can be suppressed. Therefore, arrangement of $1/4$ wavelength plate through the optical diffusion layer can be performed on one side or the both sides of a cholesteric-liquid-crystal layer.

[0018] The compatibility of suppression of a brightness fall of the direction of a transverse plane, and coloring-izing of the direction of the tropia and the suppression of color nonuniformity by reduction of the quantity of light in the direction of a transverse plane according [on this invention and] to the aforementioned equalization, As a result, from the point of obtaining the liquid crystal display which is excellent in high brightness without color nonuniformity at display grace with a transverse plane and the latus angle of visibility of the tropia etc., average Hayes is 65 - 85% above all 60 to 90%. All light transmissions are 90% or more above all 85% or more, and less than 5% of optical diffusion layer can use [the variation in Hayes within a field] preferably above all less than 6% based on the difference of maximum and the minimum value.

[0019] Although what was formed by the proper method which applied to the former, such as an optical diffusion sheet like what gave detailed irregularity structure to the front face of a transparent base material, for example by the method with proper split-face-ized methods, such as sandblasting method and embossing method, resin coat method of transparent particle content, etc., correspondingly as an optical diffusion layer can be used, what can be used preferably shows a pressure-sensitive adhesive property. According to this, a cholesteric-liquid-crystal layer and $1/4$ wavelength plate are pasted up through the optical diffusion layer, laminating unification can be carried out and there is an advantage which can omit the attachment of a separate glue line and can attain thin shape-ization.

[0020] The optical diffusion layer which shows the aforementioned pressure-sensitive adhesive property can be formed with the method which makes an adhesive layer contain a transparent particle. Proper slimes, such as a binder which makes base polymer proper polymer, such as for example, an acrylic polymer, silicone system polymer, polyester and polyurethane, a polyether, and synthetic rubber, can be used for formation of the adhesive layer.

[0021] What is excellent in optical transparency, weatherability, thermal resistance, etc., and can produce neither a float nor peeling easily due to the influence of heat or humidity can use preferably like an acrylic binder above all. Although that to which the weight average molecular weight which comes to copolymerize the acrylic monomer which consists of improvement components, such as alkyl ester of the acrylic acid with which carbon numbers, such as a methyl group, an ethyl group, and a butyl, have 20 or less alkyl group (meta), and an acrylic acid (meta), acrylic-acid (meta) hydroxyethyl, as an example of the acrylic binder in the combination from which a glass transition temperature becomes 0

degree C or less makes 100,000 or more acrylic polymers base polymer is raised, it is not limited to this.

[0022] Moreover, one sort, such as an organic system particle which consists of the silica whose mean particle diameter is 0.5-20 micrometers, for example, an alumina, a titania and a zirconia, a tin oxide, indium oxide and a cadmium oxide, an antimony oxide, etc. as a transparent particle which an adhesive layer is made to contain and which a conductive thing also becomes from the polymer for which a bridge is not constructed [a certain inorganic system particle, bridge formation, or], or two sorts or more can use. the amount of the transparent particle used -- per [2] binder (solid content) 100 weight section - 50 weight sections -- above all, although 5 - 25 weight section is common, it is not limited to this

[0023] Although the adhesion laminating by the adhesive layer of optical diffusibility can be performed by attaching an adhesive layer to the required part of the adhesion side in 1/[a cholesteric-liquid-crystal layer, its transparent base material or/, and] 4 wavelength plate A method with proper method which attaches the liquid of the binder of transparent particle content for example, directly by proper expansion methods, such as a flow casting method and a coating method, or method which forms an adhesive layer on separator according to the above, and carries out ** arrival of it etc. can perform the attachment.

[0024] The thickness of an adhesive layer can be suitably determined according to adhesive strength, an optical diffusion property, etc., and, especially generally is set to 10-50 micrometers 5-100 micrometers above all 1-500 micrometers. An adhesive layer can also be formed as a superposition layer of a different-species binder like what prepared the layer which does not contain a transparent particle in one side or both sides of a transparent particle content layer.

[0025] A polarizing plate 4 can also be formed in a polarization member like the example of drawing if needed. When preparing a polarizing plate, usually, like the example of drawing, 1/4 wavelength plate 3 is formed only in one side of the cholesteric-liquid-crystal layer 1 through the optical diffusion layer 2, and a polarizing plate 4 is formed through the 1/4 wavelength plate. This polarizing plate can penetrate the linearly polarized light of a predetermined polarization shaft to the polarizing plate for the purpose of acquiring the linearly polarized light for attaining a liquid crystal display etc., other light can use the proper thing to absorb, and there is especially no limitation about the kind.

[0026] What generally protected a polarization film, and its one side or both sides by transparent protection layer is used. Incidentally as an example of the polarization film, the film of the polyene orientation like the thing and the dehydration processing object of polyvinyl alcohol which iodine and/or the dichromatic dye were made to stick to the hydrophilic high polymer film like a polyvinyl alcohol system film, a partial formal-ized polyvinyl alcohol system film, and an ethylene-vinylacetate-copolymer system partial saponification film, and carried out extension processing, or the desalting acid-treatment object of a polyvinyl chloride etc. is raised.

[0027] Moreover, the transparent protection layer prepared in one side or both sides of a polarization film if needed can be formed in the polymer illustrated by the above-mentioned transparent base material. The transparent protection layer which consists of polymer which is excellent in transparency, a mechanical strength and thermal stability, moisture cover nature, etc. above all is desirable. Although transparent protection layer considered as the application method and film of polymer liquid, it can be formed by the method with a proper adhesion laminating method etc.

[0028] Although the cholesteric-liquid-crystal layer 1, the optical diffusion layer 2, 1/4 wavelength plate 3, and the polarizing plate 4 as occasion demands may only be piled up in the above and you may place, laminating unification is preferably carried out through glue lines, such as an adhesive layer, for the purpose of stabilization of quality, improvement in the assembly efficiency of a liquid crystal display, etc. by gap prevention of an optical axis. in addition, polarization -- the adhesive layer aiming at adhesion with other members, such as a liquid crystal cell, can also be prepared in the outside surface of a member if needed, and tentative installation covering of the front face can also be carried out with separator etc. for the purpose of protection of a pollution control etc. until it presents practical use, when the adhesive layer is exposed to a front face

[0029] The polarization member by this invention can be used for various kinds of uses according to the

former. It can use for formation of the liquid crystal display aiming at improvement in brightness etc. preferably especially. The liquid crystal display can be formed with the method which arranges a polarizing plate 41 on another side of a liquid crystal cell while arranging a polarization member to one side of a liquid crystal cell 5 through the 1/4 wavelength-plate 3 side or a polarizing plate 4 side like for example, the example of drawing, and arranges it so that a polarization member (cholesteric-liquid-crystal layer 1) may come a surface light source 8 side on the surface light source 8 (back light). In addition, in the example of drawing, the liquid crystal display is arranged through the optical diffusion sheet 7 and the condensing sheet 6 on the surface light source 8.

[0030] The surface light source 8 of the aforementioned example of a view consists of a side light type thing which comes to prepare a reflecting layer 9 in the base of the light guide plate 81 which has arranged on the side the light source 82 surrounded with the electrode holder 83, and the upper condensing sheet 6 consists of a prism sheet. Incidence is carried out to the cholesteric-liquid-crystal layer 1 of a member. according to the liquid crystal display of the example of drawing, the outgoing radiation light by the surface light source 8 diffuses with the optical diffusion sheet 7, and carries out optical-path control with the condensing sheet 6 -- having -- polarization -- It separates into the reflected light and the transmitted light, the transparency circular polarization of light diffuses through the optical diffusion layer 2, incidence is carried out to 1/4 wavelength plate 3, it is linearly-polarized-light-ized through it, a polarizing plate 4 is passed in the state with few absorption losses, incidence is carried out to a liquid crystal cell 5, and outgoing radiation of the display light is carried out through the polarizing plate 41 by the side of a check by looking.

[0031] In the above, there being few absorption losses by the polarizing plate 4 and the reflected light by the cholesteric-liquid-crystal layer 1 can be reversed by the reflecting layer 9 by the side of a light guide plate inferior surface of tongue, re-incidence can be carried out to a cholesteric-liquid-crystal layer, and it can penetrate, and when the use efficiency of light improves by use of the reflected light, the brightness of a liquid crystal display can be raised.

[0032] On the occasion of formation of a liquid crystal display, various liquid crystal displays can be formed using a liquid crystal cell proper type [, such as an active-matrix drive type thing which can use arbitrary liquid crystal cells, for example, is represented by the TFT type, a simple matrix drive type thing represented by TN type and the STN type, and a thing which attached the light filter,].

[0033] Moreover, on the occasion of formation of a liquid crystal display, like the example of drawing, two or more sorts can be arranged in one sort of the proper parts used for formation of a liquid crystal display of the condensing sheets 6, such as the polarizing plate 41 by the side of a check by looking, the optical diffusion sheet 7 and a prism sheet, and a lens sheet, a back light 8, etc., or a proper position, and other optical sheets like the phase contrast board for compensation etc. can arrange them.

[0034] What has the proper thing illustrated by the above-mentioned polarization member can be used for the polarizing plate 41 by the side of said check by looking, and *****, an acid-resisting layer, etc. can be prepared in the check-by-looking side front face if needed. ***** scatters the outdoor daylight reflected on a front face, and an acid-resisting layer suppresses surface reflection of outdoor daylight, and it is given for the purpose of prevention of the surface reflected light injuring a check by looking of the display transmitted light as a flash etc. Therefore, ***** and an acid-resisting layer can prepare the both, and can also aim at improvement from the check-by-looking prevention prevention's by the surface reflected light.

[0035] About ***** or an acid-resisting layer, especially limitation can be formed as a proper thing which there is not and shows the aforementioned function. Incidentally ***** can be formed by giving the detailed irregularity structure of light-scattering reflection nature according to the above-mentioned optical diffusion layer. Moreover, an acid-resisting layer can be formed with the interference film which consists of a coat film of plantar-flexion chip box material, such as a multilayer coat film of an inorganic oxide, and a fluorine system compound, by the coat method with vacuum evaporation methods, such as a vacuum deposition method, and an ion plating method, a sputtering method, proper plating method, sol gel method, etc. with which refractive indexes differ, for example.

[0036] On the other hand, the aforementioned phase contrast board for compensation is used if needed

for the purpose of improvement in the check-by-looking property by compensation of the phase contrast by the liquid crystal cell etc., and is usually arranged between the polarizing plate by the side of optical incidence or/and a check by looking, and a liquid crystal cell. On the occasion of the arrangement, laminating unification can be beforehand carried out with a polarization member or the polarizing plate by the side of a check by looking, and it can also use. A form birefringence film, an orientation liquid crystal layer, etc. according to the 1/4 above-mentioned wavelength plate which has proper phase contrast as a phase contrast board for compensation can be used, and the laminating of the phase contrast layer more than two-layer may be carried out for the purpose of control of optical properties, such as phase contrast.

[0037]

[Example] On a cellulose-triacetate film with an example 1 thickness of 40 micrometers, carry out the superposition application of the cholesteric-liquid-crystal polymer through a rubbing orientation film, and the reflective center wavelength which comes to carry out orientation processing 760nm, When the principal indices of refraction of the inside of a field and the thickness direction are set to n_x , n_y , and n_z through the acrylic adhesive layer of silicone resin particle content, respectively on the cholesteric-liquid-crystal layer cut from four layer structures (650nm, 550nm, or 430nm), Formula: $(n_x - n_z) N_z$ defined by $1 / (n_x - n_y)$ pasted up 1/4 wavelength plate of -1.5, carried out the adhesion laminating of the polarizing plate through the acrylic adhesive layer on the 1/4 wavelength plate further, and obtained the polarization member. For the maximum of Hayes, 82% and the minimum value are [78% and an average] 80%, and all the light transmissions of the acrylic adhesive layer of the aforementioned silicone resin particle content are 94% of things.

[0038] next, the back light top which pastes up the aforementioned polarization member on the optical incidence side of a commercial TFT liquid crystal cell in an acrylic adhesive layer through the polarizing plate side, a cell is alike on the other hand, pastes up the polarizing plate by the side of a check by looking through an acrylic adhesive layer, forms a liquid crystal display unit, and consists it of a side light type light guide plate which has a reflecting layer on the inferior surface of tongue -- polarization -- a member -- it has arranged so that a side may become a light side, and the liquid crystal display was obtained

[0039] Replaced with the example 2 polarization member, and only the polarizing plate was used, and also the liquid crystal display was obtained according to Example 1.

[0040] The acrylic adhesive layer which does not contain a silicone resin particle was used, and also it replaced with the acrylic adhesive layer of example 3 silica content, and the liquid crystal display was obtained according to Example 1.

[0041] Example 4 average Hayes also used all light transmissions as 92% of silicone resin particle content acrylic adhesive layer at 92%, and also the liquid crystal display was obtained according to Example 1.

[0042] At 80%, the minimum value considered [all light transmissions] 76% 84%, and the average considered as 94% of silicone resin particle content acrylic adhesive layer, and also the maximum of example 5 Hayes obtained the liquid crystal display according to Example 1.

[0043] The color nonuniformity of the brightness of a liquid crystal display and the direction of the tropia obtained in the examples 1-5 of an evaluation examination was investigated. The comparison result at the time of being based on the example 2 was shown in the following **.

Example []	1	Example 2	Example 3	Example 4	Example 5	Rate of the improvement in brightness (%)
152	100	153	135	152	Tropia color nonuniformity	Nothing
					Nothing	it is -- Nothing ****

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross section of the example of a liquid crystal display (polarization member)

[Description of Notations]

1: Cholesteric-liquid-crystal layer 2: Optical diffusion layer 3: 1/4 wavelength plate
4 41: Polarizing plate 5: Liquid crystal cell 8: Surface light source

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CLAIMS

[Claim(s)]

[Claim 1] the polarization which prepares 1/4 wavelength plate in one side or the both sides of a cholesteric-liquid-crystal layer of GURANJAN orientation at least through an optical diffusion layer, and is characterized by the bird clapper -- a member

[Claim 2] the polarization which has a polarizing plate in a claim 1 through 1/4 wavelength plate prepared only in one side of a cholesteric-liquid-crystal layer -- a member

[Claim 3] the polarization whose optical diffusion layer is the thing of 60 - 90% of average Hayes, and 85% or more of all light transmissions in a claim 1 or 2 -- a member

[Claim 4] the polarization which is that an optical diffusion layer indicates a pressure-sensitive adhesive property to be in claims 1-3 -- a member

[Claim 5] the polarization whose difference of the maximum of Hayes [set to claims 1-4 and / diffusion layer / optical] within a field and the minimum value is less than 6% of thing -- a member

[Claim 6] The liquid crystal display characterized by the bird clapper using a polarization member according to claim 1 to 5.

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